

Cooper Creek ECS Ecological Departure Analysis

Methods:

- LIDAR derived Canopy height and canopy density data obtained from Luis Miguel Verissimo of Michigan Tech university
- LIDAR derived Canopy Height/Density Raster data clipped to ECS boundary
- Forest Service Stand layer clipped to ECS boundary
- LIDAR Canopy Height and Density Raster data reclassified based on predefined thresholds
- Reclassified LIDAR Canopy Height and Density Raster data converted to polygons
- Canopy Height and Density polygons clipped to Forest Service Ownership boundary
- Intersection tool was run to merge FS Stand, ECS, Canopy Height, Canopy Density, and Wildlife Opening data into one polygon layer
- Resulting Intersection layer was queried based on IDT developed metric
- Area percentages for each Vegetation class in each Natural Community were compared to the NRV percentages described by BpS models to determine ecological departure based on the following equation:

$$100\% - \sum_{i=1}^n \min\{Current_i, NRV_i\}$$

- Departures scores less than 33% are minimally departed, departure scores between 33% and 66% are moderately departed, and scores above 66% are highly departed from reference conditions

Special Considerations:

Due to the low pulse density of the original LIDAR data, the canopy density model may not be completely accurate. The canopy model is good for broad-scale characterization, but may not be suitable for micro-scale analysis. However, this model is likely the best assessment in the 3D level of forest structure conditions available for the area at this time.

The Forest Service stand data layer is continually being updated. Some of this stand data may be dated and/or stand boundaries may be inaccurate. Some stands may also be inaccurately classified and/or lumped into broader categories.

Description of Ecological Systems Vegetation Classes for Cooper Creek Watershed
Chattahoochee-Oconee National Forest
March 23, 2015

Acidic Cove Forest					
5713180 - Southern & Central Appalachian Cove Forest (pg. 25-31)					
NRV %	Class Code	Veg Class	Description	Overstory Cover %	Age
4%	A	Early	Early tree regeneration phase (root and stump sprouts and seed bank)	n/a	<10 yrs
20%	B	Mid-Closed	Mid-seral closed overstory	n/a	10-99 yrs
1%	C	Late-Open	Mature forest with gaps in hemlock-hardwood forests	≤60%	100-140 yrs
22%	D	Late-Closed	Closed canopy in hemlock-hardwood forests	>60%	100-140 yrs
54%	E	Late2-Closed	Old growth closed canopy	>60%	>140 yrs

from Warwoman NRV models

Rich Cove Forest					
5713180 - Southern & Central Appalachian Cove Forest (pg. 25-31)					
NRV %	Class Code	Veg Class	Description	Overstory Cover %	Age
4%	A	Early	Early tree regeneration phase (root and stump sprouts and seed bank)	n/a	<10 yrs
20%	B	Mid-Closed	Mid-seral closed overstory	n/a	10-99 yrs
1%	C	Late-Open	Mature forest with gaps; American beech, sugar maple, tulip poplar . . .	≤60%	100-140 yrs
22%	D	Late-Closed	Closed canopy; American beech, sugar maple, tulip poplar . . .	>60%	100-140 yrs
54%	E	Late2-Closed	Old growth closed canopy	>60%	>140 yrs

from Warwoman NRV models

Northern Hardwood and Boulderfield Forests					
5713180 - Southern & Central Appalachian Cove Forest (pg. 1-5)					
NRV %	Class Code	Veg Class	Description	Overstory Cover %	Age
9%	A	Early	Typical gap replacement, mostly single to multiple tree-sized gaps	n/a	<25 yrs
18%	B	Mid-Closed	Typical stand development after tree to stand replacement events	n/a	25-75 yrs
69%	C	Late-Closed	Dense, closed forest-yellow birch, Fraser fir, red spruce, American beech . . .	>60%	>75 yrs
4%	D	Late-Open	More open stand of n. hardwoods (especially red oak)	≤60%	>75 yrs

from Southern Appalachian, Cherokee NRV models

Low to Mid-elevation Oak Forests (transitional to cove forests)					
5713150 – Southern Appalachian Oak-Forest (PG. 6-11)					
NRV %	Class Code	Veg Class	Description	Overstory Cover %	Age
5%	A	Early	Oaks mixed with subcanopy and shrub species and herbs	n/a	<20 yrs
8%	B	Mid-Closed	Mid-seral closed; old treefall gaps with closed canopy	>60%	20-69 yrs
7%	C	Mid-Open	Mid-seral open woodland with open midstory	≤60%	20-69 yrs
6%	D	Late-Open	Late-seral open forest with open midstory	≤60%	70-130 yrs
5%	E	Late-Closed	Late-seral closed canopy forest	>60%	70-130 yrs
38%	F	Late2-Open	Old growth open oak forest with open midstory	≤60%	>130 yrs
31%	G	Late2 - Closed	Old growth closed canopy mixed oak-maple-white pine forest with wee-established midstory	>60%	>130 yrs

from Warwoman NRV models

Low to Mid-elevation Oak Forests (dry-mesic)					
5713150 – Southern Appalachian Oak-Forest (PG. 6-11)					
NRV %	Class Code	Veg Class	Description	Overstory Cover %	Age
7%	A	Early	Oaks mixed with subcanopy and shrub species and herbs	n/a	<20 yrs
6%	B	Mid-Closed	Mid-seral closed; old treefall gaps with closed canopy	>60%	20-69 yrs
13%	C	Mid-Open	Mid-seral open woodland with open midstory	≤60%	20-69 yrs
14%	D	Late-Open	Late-seral open forest with open midstory	≤60%	70-130 yrs
5%	E	Late-Closed	Late-seral closed canopy forest	>60%	70-130 yrs
42%	F	Late2-Open	Old growth open oak forest with open midstory	≤60%	>130 yrs
12%	G	Late2 - Closed	Old growth closed canopy mixed oak-maple-white pine forest with wee-established midstory	>60%	>130 yrs

from Warwoman NRV models

Low to Mid-Elevation Oak Forests (dry to xeric)					
5713150 – Southern Appalachian Oak-Forest (pg. 6-11)					
NRV %	Class Code	Veg Class	Description	Overstory Cover %	Age
7%	A	Early	Oaks mixed with subcanopy and shrub species and herbs	n/a	<20 yrs
4%	B	Mid-Closed	Mid-seral closed; old treefall gaps with closed canopy	>60%	20-69 yrs
13%	C	Mid-Open	Mid-seral open woodland with open midstory	≤60%	20-69 yrs
18%	D	Late-Open	Late-seral open forest with open midstory	≤60%	70-110 yrs
3%	E	Late-Closed	Late-seral closed canopy forest	>60%	70-110 yrs
57%	F	Late2-Open	Old growth open oak forest with open midstory	≤60%	>110 yrs
1%	G	Late2 - Closed	Old growth closed canopy mixed oak-maple-white pine forest with wee-established midstory	>60%	>110 yrs

from Warwoman NRV models

Montane oak forest or High Elevation Red Oak Forests (NC)					
5713200 - Central & Southern Appalachian Montane Oak (pg. 32-35)					
NRV %	Class Code	Veg Class	Description	Overstory Cover %	Age
13%	A	Early	Treefall gaps & small-medium patches with saplings & small tress	n/a	<20 yrs
15%	B	Mid-Closed	Mid-seral closed forest with well-developed mid-story	>60%	20-79 yrs
17%	C	Mid-Open	Mid-seral fairly open forest with open mid-story & patchy shrub/herb	≤60%	20-79 yrs
15%	D	Late-Open	Late-seral with open canopy gaps; dominated by oaks & hickory	≤60%	80-130 yrs
9%	E	Late-Closed	Late-seral with few canopy gaps; closed mid and understory w red ample/white pine & little oak regen	>60%	80-130 yrs
22%	F	Late2-Open	Old growth open oak forest with open canopy gaps	≤60%	>130 yrs
9%	G	Late2 - Closed	Old growth closed canopy mixed – hardwood forest, shade tolerant mid-canopy tree common	>60%	>130 yrs

from NC departure analysis

Uncharacteristic Vegetation Classes				
As found across various ecological systems, as cited below				
NRV %	Class Code	Vegetation	Description	If Found In
0	U-WP	White Pine	Stands dominated by white pine	Any system except Acidic Cove
0	U-YP	Yellow Poplar	Stand dominated by yellow poplar	Any system except Rich Cove Forest
0	U-WLO	Non-native Wildlife Opening	Crop or non-native grasses dominated system	Any system
0	U-BR	Brush, shrubs	Brush, mountain laurel or rhododendron occurring as dominant species in forests or woodlands	Any system

**Rules for Departure Analysis for Cooper Creek Watershed
Chattahoochee-Oconee National Forest
March 23, 2015**

RULES1: use the following to identify “Uncharacteristic Vegetation”

UN1 (U-WP):FT=3 (White Pine) *and* FT=10 *and* BpS *not* Acidic Cove

UN2 (U-YP):FT= 50 (Yellow Poplar) *and* BpS *not* Rich Cove

UN3 (U-WLO)=HT <1m *and* WLO

UN4 (U-SH):

RULES2: use the following to identify “Characteristic Vegetation”

Northern Hardwood and Boulderfield Forests

NCofGA= Northern Hardwood Forest *and* HT<5m, *canopy n/a* = Class A

NCofGA = Northern Hardwood Forest *and* stand age 25-75 years, *canopy n/a*=Class B

NCofGA = Northern Hardwood Forest *and* stand age > 75 years *and* canopy cover > 60% =Class C

NCofGA = Northern Hardwood Forest *and* stand age > 75 years *and* canopy cover ≤60% =Class D

Low to Mid-elevation Oak Forests (dry-mesic)

NCofGA=Low to Mid-elevation Oak Forests (dry-mesic) *and* HT<5m, *canopy n/a*= Class A

NCofGA=Low to Mid-elevation Oak Forests (dry-mesic) *and* HT>5m *and* stand age 20-69 years *and* canopy cover > 60% = Class B

NCofGA=Low to Mid-elevation Oak Forests (dry-mesic) *and* HT>5m *and* stand age 20-69 years *and* canopy cover ≤60% = Class C

NCofGA=Low to Mid-elevation Oak Forests (dry-mesic) *and* HT>5m *and* stand age 70-130 years *and* canopy cover ≤60% = Class D

NCofGA=Low to Mid-elevation Oak Forests (dry-mesic) *and* HT>5m *and* stand age 70-130 years *and* canopy cover > 60% = Class E

NCofGA=Low to Mid-elevation Oak Forests (dry-mesic) *and* HT>5m *and* stand age > 130 years, *and*= canopy cover ≤60% = Class F

NCofGA=Low to Mid-elevation Oak Forests (dry-mesic) *and* HT>5m *and* stand age > 130 years, *and*= canopy cover > 60% = Class G

Low to Mid-elevation Oak Forests (transitional to cove forests)

NCofGA=Low to Mid-elevation Oak Forests (transitional to cove forests) *and* HT<5m, *canopy n/a*= Class A

NCofGA=Low to Mid-elevation Oak Forests (transitional to cove forests) *and* HT>5m *and* stand age 20-69 years *and* canopy cover > 60% = Class B

NCofGA=Low to Mid-elevation Oak Forests (transitional to cove forests) *and* HT>5m *and* stand age 20-69 years *and* canopy cover ≤60% = Class C

NCofGA=Low to Mid-elevation Oak Forests (transitional to cove forests) *and* HT>5m *and* stand age 70-130 years *and* canopy cover ≤60% = Class D

NCofGA=Low to Mid-elevation Oak Forests (transitional to cove forests) *and* HT>5m *and* stand age 70-130 years *and* canopy cover > 60% = Class E

NCofGA=Low to Mid-elevation Oak Forests (transitional to cove forests) *and* HT>5m *and* stand age > 130 years, *and* canopy cover ≤60% = Class F

NCofGA=Low to Mid-elevation Oak Forests (transitional to cove forests) *and* HT>5m *and* stand age > 130 years, *and* canopy cover > 60% = Class G

* all canopy breaks changes to 60% (late classes were 80%)

Low to Mid-elevation Oak Forests (dry-to xeric)

NCofGA=Low to Mid-elevation Oak Forests (dry to xeric) *and* HT<5m, *canopy n/a*= Class A

NCofGA=Low to Mid-elevation Oak Forests (dry to xeric) *and* HT>5m *and* stand age 20-69 years *and* canopy cover > 60% = Class B

NCofGA=Low to Mid-elevation Oak Forests (dry to xeric) *and* HT>5m *and* stand age 20-69 years *and* canopy cover ≤60% = Class C

NCofGA=Low to Mid-elevation Oak Forests (dry to xeric) *and* HT>5m *and* stand age 70-110 years *and* canopy cover ≤60% = Class D

NCofGA=Low to Mid-elevation Oak Forests (dry to xeric) *and* HT>5m *and* stand age 70-110 years *and* canopy cover > 60% = Class E

NCofGA=Low to Mid-elevation Oak Forests (dry to xeric) *and* HT>5m *and* stand age > 110 years, *and* canopy cover ≤60% = Class F

NCofGA=Low to Mid-elevation Oak Forests (dry to xeric) *and* HT>5m *and* stand age > 110 years, *and* canopy cover > 60% = Class G

* all canopy breaks changes to 60% (late classes were 80%)

Rich Cove

NCofGA = Rich Cove Forest *and* HT<5m, *canopy n/a*= Class A

NCofGA = Rich Cove Forest *and* HT>5m *and* stand age 10-99 years, *canopy n/a*= Class B

NCofGA = Rich Cove Forest *and* HT>5m *and* stand age 100-140 years *and* canopy cover ≤60% = Class C

NCofGA = Rich Cove Forest *and* HT>5m *and* stand age 100-140 years *and* canopy cover > 60% = Class D

NCofGA = Rich Cove Forest *and* HT>5m *and* stand age > 140 years, *canopy n/a*= Class G

Comment: Class E and F not used

Acidic Cove

NCofGA = Acidic Cove Forest *and* HT<5m, *canopy n/a*= Class A

NCofGA = Acidic Cove Forest *and* HT>5m *and* stand age 10-99 years, *canopy n/a*= Class B

NCofGA = Acidic Cove Forest *and* HT>5m *and* stand age 100-140 years *and* canopy cover ≤60% = Class C

NCofGA = Acidic Cove Forest *and* HT>5m *and* stand age 100-140 years *and* canopy cover > 60% = Class D

NCofGA = Acidic Cove Forest *and* HT>5m *and* stand age > 140 years, *canopy n/a*= Class G

Comment: Class E and F not used

Montane oak forest (High Elevation Red Oak Forests)

NCofGA= Montane Oak Forest *and* HT<5m, *canopy n/a*= Class A

NCofGA= Montane Oak Forest *and* HT>5m *and* stand age 20-79 years *and* canopy cover > 60% = Class B

NCofGA= Montane Oak Forest *and* HT>5m *and* stand age 20-79 years *and* canopy cover ≤60% = Class C

NCofGA= Montane Oak Forest *and* HT>5m *and* stand age 80-130 years *and* canopy cover ≤60% = Class D

NCofGA= Montane Oak Forest *and* HT>5m *and* stand age 80-130 years *and* canopy cover > 60% = Class E

NCofGA= Montane Oak Forest *and* HT>5m *and* stand age > 130 years, *and* canopy cover ≤60% = Class F

NCofGA= Montane Oak Forest *and* HT>5m *and* stand age > 130 years, *and* canopy cover > 60% = Class G

*NCofGA=Natural Communities of Georgia

Acidic Cove Forest - 3,890.95 ac						
Class Code	Veg Class	GIS Acres	Current Range of Variation %	Natural Range of Variation %	Departure Difference	Departure Component
A	Early	52.18	1.3	4	-2.7	1.3
B	Mid-Closed	2645.93	68.0	20	48	20
C	Late-Open	34.88	0.9	1	-0.1	0.9
D	Late-Closed	1032.84	26.5	22	4.5	22
E	Late2-Closed	9.82	0.3	54	-53.7	0.3
U-YP	Uncharacteristic Yellow Poplar	24.61	0.6	0	0.6	0
U-WLO	Uncharacteristic Wildlife Opening	29.66	0.8	0	0.8	0
No Stand Data - 61.02 acres or 1.6% of Acidic Cove Forests are missing stand data					Sum:	44.5
					Departure Score:	55.5

Rich Cove Forest - 3,139.4 ac						
Class Code	Veg Class	GIS Acres	Current Range of Variation %	Natural Range of Variation %	Departure Difference	Departure Component
A	Early	14.27	0.5	4	-3.5	0.5
B	Mid-Closed	2260.02	72.0	20	52.0	20
C	Late-Open	159.90	5.1	1	4.1	1
D	Late-Closed	636.28	20.3	22	-1.7	20.3
E	Late2-Closed	29.39	0.9	54	-53.1	0.9
U-WP	Uncharacteristic White Pine	20.01	0.6	0	0.6	0
U-WLO	Uncharacteristic Wildlife Opening	2.16	0.1	0	0.8	0
No Stand Data - 17.4 acres or .6% of Rich Cove Forests are missing stand data					Sum:	42.7
					Departure Score:	57.3

Northern Hardwood and Boulderfield Forests - 68 ac

Class Code	Veg Class	GIS Acres	Current Range of Variation %	Natural Range of Variation %	Departure Difference	Departure Component
A	Early	0.03	0.04	9	-9.0	0.04
B	Mid-Closed	0.00	0	18	-18.0	0
C	Late-Closed	67.17	98.8	69	29.8	69
D	Late-Open	0.09	0.1	4	-3.9	0.1
U-WP	Uncharacteristic White Pine	0.68	1.0	0	1.0	0
					Sum:	69.2
					Departure Score:	30.8

Low to Mid-elevation Oak Forests (Transitional to Cove Forests) - 3,912.5 ac

Class Code	Veg Class	GIS Acres	Current Range of Variation %	Natural Range of Variation %	Departure Difference	Departure Component
A	Early	11.35	0.3	5	-4.7	0.3
B	Mid-Closed	495.16	12.7	8	4.7	8
C	Mid-Open	181.28	4.6	7	-2.4	4.6
D	Late-Open	294.00	7.5	6	1.5	6
E	Late-Closed	1752.20	44.8	5	39.8	5
F	Late2-Open	21.66	0.6	38	-37.4	0.6
G	Late2 -Closed	245.48	6.3	31	-24.7	6.3
U-WP	Uncharacteristic White Pine	840.39	21.5	0	21.5	0
U-YP	Uncharacteristic Yellow Poplar	30.85	0.8	0	0.8	0
U-WLO	Uncharacteristic Wildlife Opening	2.46	0.1	0	0.1	0
No Stand Data - 37.6 acres or 1% of Low to Mid Elevation Oak Forests (Transitional To Cove) are missing stand data					Sum:	30.8
					Departure Score:	69.2

Low to Mid-elevation Oak Forests (Dry-Mesic) - 5,854.4 ac

Class Code	Veg Class	GIS Acres	Current Range of Variation %	Natural Range of Variation %	Departure Difference	Departure Component
A	Early	21.45	0.4	7	-6.6	0.4
B	Mid-Closed	718.78	12.3	6	6.3	6
C	Mid-Open	172.55	2.9	13	-10.1	2.9
D	Late-Open	451.34	7.7	14	-6.3	7.7
E	Late-Closed	2716.27	46.4	5	41.4	5
F	Late2-Open	38.93	0.7	42	-41.3	0.7
G	Late2 -Closed	285.37	4.9	12	-7.1	4.9
U-WP	Uncharacteristic White Pine	1276.26	21.8	0	21.8	0
U-YP	Uncharacteristic Yellow Poplar	114.22	2.0	0	2	0
U-WLO	Uncharacteristic Wildlife Opening	7.12	0.1	0	0.1	0
No Stand Data - 52.1 acres or .9% of Low to Mid Elevation Oak Forests (Dry-Mesic) are missing stand data					Sum:	27.6
					Departure Score:	72.4

Low to Mid-Elevation Oak Forests (Dry to Xeric) - 11,512.1 ac

Class Code	Veg Class	GIS Acres	Current Range of Variation %	Natural Range of Variation %	Departure Difference	Departure Component
A	Early	40.21	0.3	7	-6.7	0.3
B	Mid-Closed	1581.97	13.7	4	9.7	4
C	Mid-Open	395.72	3.4	13	-9.6	3.4
D	Late-Open	254.09	2.2	18	-15.8	2.2
E	Late-Closed	1892.98	16.4	3	13.4	3
F	Late2-Open	382.00	3.3	57	-53.7	3.3
G	Late2 -Closed	2382.88	20.7	1	19.7	1
U-WP	Uncharacteristic White Pine	4432.84	38.5	0	38.5	0
U-YP	Uncharacteristic Yellow Poplar	64.44	0.6	0	0.6	0
U-WLO	Uncharacteristic Wildlife Opening	28.34	0.2	0	0.2	0
No Stand Data - 56.6 acres or .5% of Low to Mid Elevation Oak Forests (Dry to Xeric) are missing stand data					Sum:	17.3
					Departure Score:	82.7

**Montane Oak Forest (High Elevation Red Oak
Foresy) - 1,248.3 ac**

Class Code	Veg Class	GIS Acres	Current Range of Variation %	Natural Range of Variation %	Departure Difference	Departure Component
A	Early	3.15	0.3	7	-6.7	0.3
B	Mid-Closed	96.98	7.8	26	-18.2	7.8
C	Mid-Open	8.26	0.7	20	-19.3	0.7
D	Late-Open	33.51	2.7	12	-9.3	2.7
E	Late-Closed	847.95	67.9	18	49.9	18
F	Late2-Open	4.43	0.4	2	-1.6	0.4
G	Late2 -Closed	72.76	5.8	14	-8.2	5.8
U-WP	Uncharacteristic White Pine	181.23	14.5	0	14.5	0
U-WLO	Uncharacteristic Wildlife Opening	0.07	0.006	0	0.006	0
					Sum:	35.5
					Departure Score:	64.5

**Uncharacteristic
Vegetation Classes**

Class Code	Vegetation	If Found In	GIS Acres	Percent of Project Area
U-WP	White Pine	Any system except Acidic Cove	6751.4	22.79%
U-YP	Yellow Poplar	Any system except Rich Cove Forest	234.1	0.79%
U-WLO	Wildlife Opening	Any system	69.8	0.24%
U-BR	Brush, shrubs	Any system	* None in Stand Data	-